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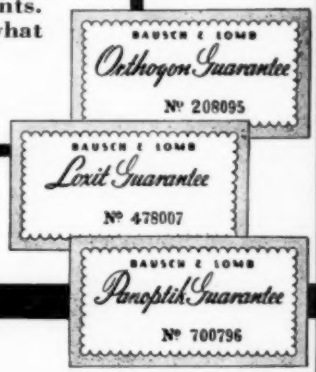

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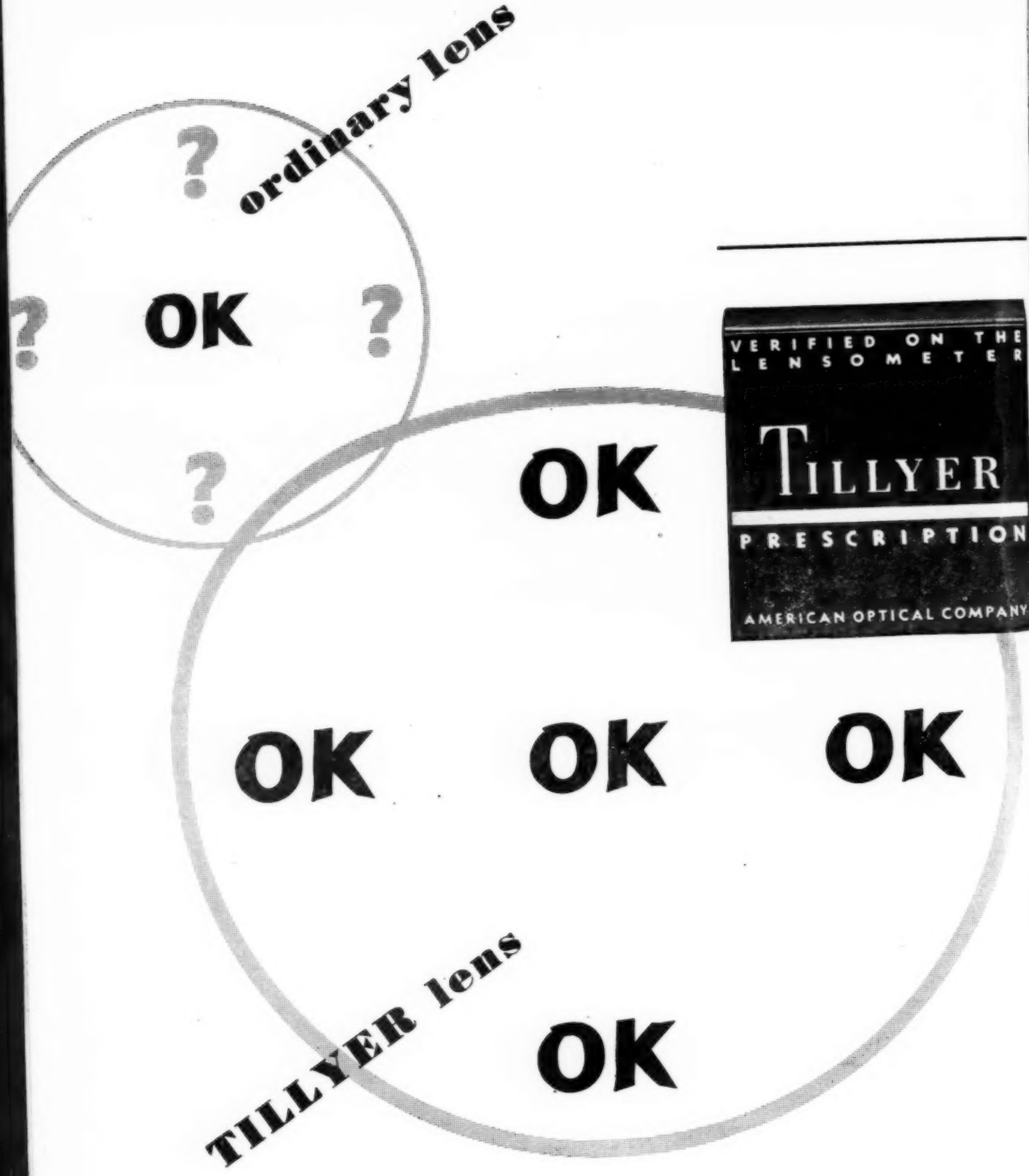
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?
?
OK
?
?
OK
OK
OK
OK
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OK
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TILLYER
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AMERICAN JOURNAL OF OPTOMETRY

Vol. 16 JANUARY, 1939 No. 1

OPTOMETRIC CASE RECORD CHARTS*

Ralph H. Green, O.D., D.O.S.
Boston, Mass.
and
William V. Emmons, O.D.
Boston, Mass.

The purpose of maintaining complete case reports is three-fold:

1. Comparative value.
2. Legal aspect.
3. Statistical purposes.

First. There are many pathological ocular conditions that can be detected only through a comparison of findings at previous examinations with those found in a later one. The detection of early ocular pathologies is enhanced, when a careful record of the results of the previous examination is available. This detection of early pathologies calls for completeness of examination, coupled with illustrations of abnormal conditions, and an appropriate method of recording.

Second. Every optometrist should protect both himself and his patient in the event some question may arise legally, in which case the optometrist may be called upon to give court testimony as to the visual status of the patient in question, at the last examination. It is embarrassing not to have such data carefully recorded.

Third. For those statistically minded, it will be found that a great deal of information may be gleaned and tabulated, when an accurate and complete record is maintained.

As a result of the analysis of the many and varied cases handled at the Massachusetts Optometric Clinic,[1] we are pleased to offer a series of comprehensive Case Record Charts in outline form, devised to meet the needs of thorough and conscientious optometrists. At this point we might

*Submitted for publication October 27, 1938.
[1]Department of Massachusetts School of Optometry.

MASSACHUSETTS OPTOMETRIC CLINIC

VISUAL SURVEY RECORD

NAME..... AGE..... DATE.....

ADDRESS.....CLINICAL ROOM #.....

REFERRED BY.....OCCUPATION.....AVOCATION.....

(All items on this sheet must be filled in)

CASE HISTORY

COMPLAINTS

Present Ꞩ:	O. D..... O. S.....Add O. S.....	Dist. Vision with Present Ꞩ	O. D..... O. S..... O. U.....	Near Vision with Present Ꞩ at 16"	O. D..... O. S..... O. U.....
Naked Vision	O. D..... O. S..... O. U.....	Pin Hole	O. D..... O. S.....	Near Vision at 16 inches	O. D..... O. S..... O. U.....
Interpupillary Distance:	Distance			Near	

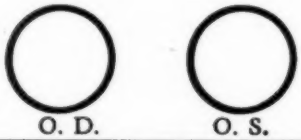
EXTERNAL EXAMINATION:

- Ewigg's Sign
- Lids
- Lid Margins
- Cilia
- Puncta (regurgitation test)
- Conjunctiva (palpebral & ocular)
- Cornea
- Sclera
- Anterior Chamber
- Irides
- Tension
- Special Remarks:
  - Facial and Cranial Asymmetry
  - Carriage of head
  - Facial characteristics

OPHTHALMOSCOPE

Media:
O. D.
O. S.

Fundus:
O. D.
O. S.



O. D. O. S.

Rotations: O. D. O. S. Versions: P. P. Conv.

Cover Test: Distance Near Field of Fixation:

Pupils: Reaction to light—Direct..... Indirect..... Acc.-Conv.....
Size: O. D.....mm. O. S.....mm. Shape: O. D.....O. S.....Iris O. D.....
Reaction time:..... Extent: .....Color O. S.....

KERATOMETER: O. D. Primary O. S. Primary
Type: ..... Secondary Secondary

STATIC SKIAMETRY O. D..... O. D.....
Vision O. U.....
at..... "(net) O. S..... O. S.....

DYNAMIC SKIAMETRY O. D. Add..... O. D.....
Vision O. U.....
at..... " O. S. Add..... O. S.....

SUBJECTIVE O. D..... O. D.....
O. U..... Vision O. U.....
FOG TEST: O. S..... O. S.....

(Front)

DUOCHROME CHECK-TEST: O. D. O. S. O. U.

FUSED CROSS-CYLINDER AT ....": O. D. O. S. O. U.

PRESBYOPIA: Corrected Near V. A. with .... add O. D. O. S. O. U. Range...." - ...."

PHORIAS: Habit —Distance..... Near (.....") .....
Induced—Distance..... Near (.....") .....(+1.00 add).....

DUCTIONS:

		Blur	*Break*	*Recovery*
Distance:	N. R. C.			
	P. R. C.			
Near: ....."	N. R. C.			
	P. R. C.			

Vertical: Distance: S.....S..... Near: S.....S.....
O. D. I.....O. S. I.....O. D. I.....O. S. I.....

ACCOMMODATION:
Amplitude: (Method—.....) O. D.....O. S.....O. U.....
P. R. A. Distance..... N. R. A. Distance.....
Near (.....") ..... Near (.....") .....
N. A. (16") O. D..... O. S..... —3.00 test.....

UNFUSED CROSS CYLINDER at....": Add O. D. O. S. Induced Phoria

SPECIAL TESTS:

MEASURE OF STEREOPSIS: COLOR VISION:

VISUAL FIELDS:
Type of Instrument
Comments:

DIAGNOSIS:

ADVICE TO PATIENT:

TREATMENT ADVISED:

FINAL Rx: Distance O. D.....Vision O. D..... Constant wear
O. U.....
O. S..... O. S..... Close wear
Near O. D..... O. D.....
O. U.....Special use
O. S..... O. S.....

EXAMINED BY: ASSISTANT:

CHECKED BY:

(Reverse)

MASSACHUSETTS OPTOMETRIC CLINIC

VISUAL FIELD STUDY CASE RECORD

(Attach to Visual Survey Record)

STARTED.....

NAME ..... TIME COMPLETED..... DATE.....

PERTINENT CASE HISTORY AND COMPLAINTS

PRESENT Rx

O. D. ..... Add O. D. .....

O. S. ..... O. S. .....

CORRECTED VISION	NAKED VISION	PINHOLE VISION
O. D.	O. D.	(less than 20/30)
O. S.	O. S.	O. D. .....
O. U.	O. U.	O. S. .....

OPHTHALMOSCOPE

Media

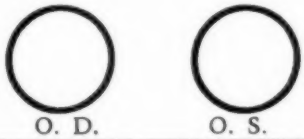
O. D.

O. S.

Fundus

O. D.

O. S.



O. D. O. S.

COLOR VISION (test)

EXTERNAL EXAMINATION

a—Size of pupils (in position of test)—Myotic—Medium—Mydriasis

b—Position of eyeball—Protruding—Average—Deep-seated

c—Width of palpebral fissure

d—Special remarks relative to bony prominences of face (facial contour)

e—Depth of anterior chamber to plane of iris

ADVISABILITY OF PATIENT'S WEARING DISTANT Rx

COMMENTS

a—Mental Reaction—Quick—Average—Slow

b—Intelligence of patient and reliability of results

c—Method of signal—Voice—Tap— .....

d—Color recognition—Full saturation—First appearance (hue recognition)

e—Direction of test object—Visibility to Invisibility
Invisibility to Visibility

f—Method of exposing target—Continual exposure
Intermittent exposure (pre-exposure)

g—Special fixation devices or methods

PERIPHERAL LIMIT ANALYSIS (Device.....Lighting.....F. C.)

O. D.

Form (target size)
Blue (target size)
Red (target size)
Green (target size)

O. S.

Form (target size)
Blue (target size)
Red (target size)
Green (target size)

(Front)

CENTRAL AND PARACENTRAL FIELD ANALYSIS (Device....Lighting....F. C.)

Radial length of instrument from outer canthus of patient to point of fixation.....:

In all stereoscopic devices, record prism power necessary to align for points of easiest fusion. B. I. B. O. B. U. B. D.

O. D.
- Central (target size)
- Paracentral (target size)

O. S.
- Central (target size)
- Paracentral (target size)

BLIND SPOTS (target size)

All enlargements require a description

O. D.
- Size Analysis
- Location

O. S.
- Size Analysis
- Location

SCOTOMA RECORDINGS

indistinct
relative
absolute

DIAGNOSIS

ADVICE TO PATIENT

TREATMENT ADVISED

SPECIAL REMARKS

EXAMINED BY: ASSISTANT:

ACCEPTED BY:

(Reverse)

MASSACHUSETTS OPTOMETRIC CLINIC

STRABISMUS CASE RECORD

NAME ..... AGE ..... DATE .....

CASE HISTORY (to supplement regular questionnaire)

a—Age of onset.
b—Constant or periodic at onset
c—Direction of original squint
d—Which eye squinted or was it alternating
e—Heredity
f—Supposed cause (fright, fall, blow, tantrums, convulsions, etc.)
g—Illnesses preceding strabismus (nervousness, colic, enteric disorders, measles, whooping cough, scarlet fever, etc.)
h—Has the deviation become more or less marked as child grew older
i—Handedness (natural and any history of altered handedness)
j—What has been done for the condition to date

NAKED VISION O. D. .....
O. S. .....

Amblyopic Eye
Light Perception
Quantitative
Qualitative
Finger Vision at ..... feet
Special Chart

COVER TEST: Distance ..... Near .....
Binocular phase
Monocular phase

ROTATION TEST (concentrated light source—8 directions)
O. D.
O. S.

VERSION TEST
Comitancy
Concomitancy
Non-comitancy

FIXATION (concentrated light source)
In all questionable cases an accurate measure of fixation ability should be made by measuring field of fixation.

O. D.
Fixation: Accurate—Adapted—Lost
Reaction Time: Rapid—Slow—Erratic

O. S.
Fixation: Accurate—Adapted—Lost
Reaction Time: Rapid—Slow—Erratic

PROJECTION OF SQUINTING EYE (bull's eye target)
True—False—Erratic (description)

STRABISMOMETRY
Objective finding—Perimeter .....
Subjective finding—Stereoscopic Device .....
Diplopia Method .....
(Compare primary with secondary deviation)

KERATOMETER (if amblyopia high, use special attachment to assist fixation)
Type ..... O. D. Primary O. S. Primary
Secondary Secondary

STATIC SKIAMETRY (monocular method—occlude eye not under test)
at ..... " (net) O. D. ..... Vision O. D. .....
O. S. ..... O. S. .....

(Front)

DYNAMIC SKIAMETRY (Method) (Monocular Test)

at....." (record total lens value in place)

O. D. ..... Vision O. D.....

O. S. ..... O. S.....

SUBJECTIVE FOG TEST

O. D. ..... Vision O. D.....

O. S. ..... O. S.....

BINOCULAR STUDIES (Stereoscope)

a—Diplopia (binocular perception)

b—Superimposition

c—Stereopsis

d—Myo-fusion

e—Complete suppression

Monolateral — Macular suppression

Alternating — Perimacular suppression

MONOCULAR STUDIES	O. D.	O. S.
a—Dynamic cross-cylinder		
b—P. A.		
c—N. A.		
d—Amplitude of accommodation		

HALL SELECTION TEST AT 20"

RETINAL CORRESPONDENCE TEST (after-image test—15-20 seconds exposure)

Illustration

Description

Perfect

Anomalous

Unreliable

Intermittent

FIELD STUDY RESULTS

SPECIAL OBSERVATIONS

SPECIAL TESTS

℞ ADVISED

O. D. ..... Vision O. D. .....

O. S. ..... O. S. .....

To be worn (distance, near, constantly, special wear)

Special devices

DIAGNOSIS

PROGNOSIS

OUTLINE OF TREATMENT (including home treatment)

EXAMINED BY: ASSISTANT:

ACCEPTED BY:

(Reverse)

add, that in all we feel the need for five separate and distinct types of case records. Three of these we are presenting at this time. The remaining two, one for use in cases in which sub-normal visual aids are required and the other for use in cases in which orthoptics are prescribed will be presented at a later date. To return, however, to the general discussion of record charts and their specific requirements, some optometrists claim that such forms are of use only to clinical institutions, but a careful inspection will result in an agreement with us that the chart suggestions herewith presented are highly elastic and can meet the needs of the vast majority of cases (including many special types), and can readily be adapted to the individual's practice.

The first of the three records we present is the basic or visual survey, which is mainly for the purpose of outlining and guiding both the refractive and myologic portions of the routine examination. Sufficient space has been allowed for detailed case history and complaints, which is generally neglected in case records. The record especially guides the examiner through the usual preliminary phases to the actual refractive and myologic procedure, by outlining such steps as constitute a complete study concerning the health of the visual and oculo-motor apparatus.

Following the internal and external inspection of the eyeballs and their surrounding structures is an outline for the refractive investigation of the eyes. This in turn is followed by an outline of those tests concerned with the study of the accommodation and convergence amplitudes and their association to each other.

The record also permits a summary of the findings with the resultant classification, advised treatment, and final disposition of case.

When as a result of the basic visual survey, a visual field study is advisable, the second or visual field study record is employed. The main purpose in the use of this record is that it requires the recording of *all* conditions under which the fields are studied, as well as such information as we feel pertinent to arriving at a final analysis from this special study. This record permits the findings to be analyzed by any practitioner although he is not in immediate contact with the patient. On the reverse side of the record will be found graphs on which the results of the field study may be recorded, and which make for easy analysis of the findings.

For some time, have we felt the need for a special routine in Strabismus cases. The usual visual survey record is wholly inadequate, both as a guide and as a means of recording the results in the study of

this type of case. The suggested form especially outlines those tests from which we gain the most information relative to the binocular problem. There is also outlined a special case history to supplement that regularly used, in an effort to gain more information concerning the Strabismus. We feel the need of such a case record, since strabismus cases are in the minority, and unless the practitioner deals with such cases daily, his method of investigating, classifying, and outlining the treatment is more or less irregular.

The charts in use at the Massachusetts Optometric Clinic are eight inches in width and are fourteen inches in length, each chart printed on both sides of the record blank. This is referred to on the following outline as "front" and "reverse," the material herewith presented being complete except for the omission of perimeter field charts which appears at the bottom of the reverse side of Chart 2.

DR. RALPH H. GREEN, *and*
DR. WILLIAM V. EMMONS.
MASSACHUSETTS SCHOOL OF OPTOMETRY
DEPARTMENT OF CLINICS
1112 BOYLSTON STREET
BOSTON, MASS.

THE SO-CALLED PHYSIOLOGIC EXOPHORIA*

Thomas G. Atkinson, M.D.
Dean of Pathology Department
Northern Illinois College of Optometry
Chicago, Ill.

Whether "physiologic exophoria" is or is not an appropriate term for this phenomenon depends upon what is meant by a phoria. The common understanding of a phoria, I believe, is the movement made by the eyes from a status in which there is supposed to be some degree of neuro-muscular tension, and therefore of imbalance, to a status of neuro-muscular equilibrium or rest, or at least to one of less tension, when all or part of the originally existing tension is released.

If this be the idea, then physiologic exophoria is a misnomer. There is no neuro-muscular tension or precarious equilibrium where a response is being made to a stimulus, or constellation of stimuli, satisfying the urge created by the stimulus. A stimulus must be regarded as disturbing the equilibrium of the neural system, of which disturbance the "affect" (i.e., the feeling or urge) is the conscious index. The adequate response, with its distribution of innervation and inhibition over the appropriate pathways, restores equilibrium, as indicated by the satisfaction of the affect.

At all events, whatever the name given to the phenomenon, modern neurology requires that we revise our concept of the nature and significance of what we now call the physiologic exophoria.

The prevailing concept is about as follows: Fixation convergence is made up of three components, namely, postural tonus, accommodative convergence due to associative stimulation from the ciliaries, and the fusional complement motivated by the desire for fused central images. (The nearness-concept factor is here omitted.) By dissociation with vertical prisms the desire for fusion is cancelled, and this component of

*Submitted for publication Dec. 28, 1938.

convergence is therefore no longer performed. Whatever convergence is now in effect represents postural tonus and accommodative convergence due to associative stimulation from the ciliaries. And the lapse from full fixation convergence to this dissociation status, constitutes the physiologic exophoria.

This concept, convenient as it may be for working purposes, does not truly represent the real state of affairs.

The visual response does not consist of an assemblage of separate simultaneous reflexes, like the assembled parts of a machine, connected by switchboard devices, from which any part or parts can be detached leaving the mathematical sum of the remainder. It is a total unitary response, made to an equally total stimulus-pattern, in which the various special reflexes are patterns within the total pattern, all inherently integrated and predetermined. The basic character and unitary quality of the response cannot be varied. But the quantitative distribution of innervation and inhibition among the special reflexes within the total pattern can be, and is, varied with uncanny adaptability according to the demands of the special patterns within the total stimulus-pattern.

An analogy might, perhaps, be drawn between it and the behavior of the feet and legs in walking, which is also an inherent response. To walk at all, one must innervate and inhibit, as a unit, a predetermined group of nerve-muscles in a predetermined total pattern. But within this total pattern one can, and does,—not only as to different individuals, but in the same individual, continually, as he walks,—vary the distribution of innervation and inhibition to the various muscles, according to the varying elements of pressure, muscle-sense, etc., in the stimulus-pattern. One does not here speak of "association" between the various special reflexes, in the sense that one stimulates the operation of another in virtue of oft-repeated simultaneous performance. They are all integrated within a total pattern, and in accordance with that pattern must be operated unitarily.

The same concept must be applied to accommodation and convergence in the visual act. They are not separate reflexes, performed in certain ratios in virtue of repeated simultaneous performance, as commonly understood by the term "association." They are integrated parts of a total pattern of visual response, and in accordance with that inherent total pattern must be operated unitarily. But the distribution of innervation and inhibition as between these two integral reflexes varies with an uncanny

adaptability to the demands of the component elements of the stimulus-pattern, i.e., the visual image pattern.

Now let us see what happens under "dissociation."

If we put lateral prisms, base in or out, before the eyes, we do not make any radical change in the stimulus-pattern. We merely call for a little more or a little less distribution of innervation into the special convergence reflex within the total response pattern,—comparable, let us say, to giving a person lighter or heavier shoes to walk in. The attention images fall on the two retinae a little nearer to or further from the foveae than they would without the prism, but still laterally, which is still the normal stimulus-pattern for the inherent convergence-fixation response, to which this integral part of the total response still reacts with its accustomed adaptability.

But if we put vertical prisms before the eyes, we make a very radical disruption of the stimulus-pattern. There is no inherent, predetermined stimulus-response relation between attention images falling above and below the foveae. There is no inherent convergence reaction up and down. We have, in short, introduced an element into the stimulus-pattern for which there is no inherent reaction; comparable, let us say again, to fitting the shoe with some bizarre contact-surface for walking, say a hollow space against the sole of the foot. So far as this element is concerned, the response mechanism is bewildered, non-plussed.

What happens? The total-pattern response still occurs, including convergence. But in the absence of this particular guiding element in the stimulus-pattern this particular special reflex in the total pattern "goes wild." Perhaps (usually) it receives smaller distribution of innervation than normal, perhaps (less frequently) larger. And the difference between this indeterminate convergence and the controlled fixation convergence represents the so-called physiologic exophoria, plus or minus.

This explanation eliminates, as it should be eliminated, the role of associative stimulation from the ciliaries.

But, says someone, there *is* a ratio between accommodation and convergence under dissociation; and convergence can be increased or decreased under dissociation by increasing or decreasing the accommodation.

The answer to the first statement is, Not nearly so constant a ratio as we are in the habit of postulating, as every clinician knows. If associative stimulation by the ciliaries were the determining factor, the ratio

between them would *always* obtain. But, granting the ratio where it does obtain, and granting the second of the above propositions, the answer to both is twofold.

(a) The increase or decrease of the accommodation demand increases or decreases the vigor of the total response, and under the uncontrolled conditions which pertain to the special convergence reflex during dissociation it is quite natural that it should partake of this increase or decrease in vigor.

(b) It is an essential part of the new concept that the total, unitary character of the visual reaction applies to the stimulus-pattern no less than to the response-pattern. In spite of the special reflexes within the total pattern, there is no strict one-to-one relation between each special reflex and the particular element in the stimulus-pattern commonly associated with it. The visual reaction is a total, unitary response to a total, unitary stimulus. Accommodation does not come into play by reason of blurred images alone; nor convergence by reason of eccentric images alone. Both are integrated parts of an unanalyzable total response to an equally unanalyzable total stimulus.

What difference, if any, does the new concept imply in our clinical interpretations of the physiologic exophoria and its findings? I am not at all sure that it necessarily implies any. The substitution of Einstein's doctrines of gravity and light for the older theories of Newton and Huyguens, respectively, did not invalidate any of the practical working values of the latter. But it opened the way for other and still further-reaching values. And it may well be that this truer concept of what lies behind the so-called physiologic exophoria, and, indeed, behind the entire visual reaction, will lead to further-reaching interpretations of our phoria findings.

DR. THOMAS G. ATKINSON
PATHOLOGY DEPT.
NORTHERN ILLINOIS COLLEGE OF OPTOMETRY
DREXEL BLVD. & 42 PLACE
CHICAGO, ILL.

COLOR—WHAT IS IT AND HOW DO WE SEE IT*

F. L. Avera
Los Angeles, Calif.

The general subject of Color is perhaps one of the most ramified in the entire fields of physics, chemistry, physiology and psychology; all of which are intimately concerned in its expression.

The actual mechanics involved in the primal origin of color spectra, as well as its ultimate cortical cognition by man, is shrouded by the lack of a completely satisfactory understanding. In between these extremes, however, we have a considerable matrix of facts and theories that outline man's knowledge of color and its allied phenomena.

The existence of color as monochromatic hues is something altogether different to the physicist than it is to the physiologist concerned with the visual reception of color by man. The physicist has a rigid reference frame for the isolation of pure color through the use of the refractive index of spectroscopic light analysis equipment. The fact that a pure hue, in a wave length sense, can be reproduced in man's brain by a combination of hues, as well as his pure hue, does not affect the physicist in his conception of color. Thus yellow, for example, may be considered a pure hue to the physicist and yet be considered a combination color by the physiologist and psychologist, as will be seen later.

The following is the conventional physics demarcation of the color spectrum, in terms of Ångström units; taken to be 10-8 cm.

Violet	4120
Blue Violet	4390
Blue	4370
Green-Blue	4980
Green	5150
Yellow-Green	5680

*Copyright retained by author. Submitted for publication Dec. 14, 1938.

Yellow	5770
Orange-Yellow	5920
Orange	6000
Red-Orange	6310
Red	6730

COMPLIMENTARIES:

6500	4960
6090	4935
5910	4900
5860	4875
5800	4825
5785	4805
5765	4775
5755	4745
5740	4720
5730	4665
5720	4590
5705	4430

The emission of light quanta as color spectra is considerably better known to the field of physics than is the selective absorption of light to that of chemistry. Qualitatively speaking the emission of light quanta is admirably explained by the reduction of eigenfunction radii. The term "eigenfunction" is chosen as most representative of the prevalent quantized wave concept of orbital electronic lattice. It is well known that radiant energy is absorbed when the presence of heat increases the eigenfunction radii. Conversely; it is emitted when the radii are reduced, according to the familiar Plank's E=hv.*

Chemical selective light absorption has many existent hypotheses, all of which are claimed to have inherent weaknesses which fail to completely cover the empirically observed phenomena. Three of these receive general consideration.

The quinonoid hypothesis states that the quinonoid ring formation is responsible for selective light absorption. This ring structure, as present in Quinone, will be remembered as the benzene ring nucleus with two double valence bonds present.

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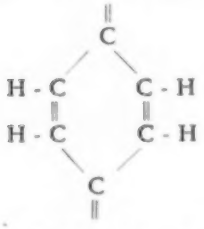
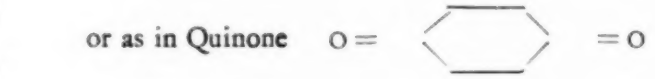
*E equals the energy of light quanta emitted.
h equals 6.5 times 10 minus 27 zeros: ergs. v equals light frequency.

The quinonoid theory, however, is unable to explain the presence of color in structures like the yellow of dimethyl fulvene: (C(CH3)2)2.



or as in Quinone



A second alternative hypothesis utilizes the tautomeric concept wherein electrons are considered migratory from position to position within a molecule, with the valence bonds altering constantly to accommodate this tautomerism. This concept involves an oscillatory type of tautomerism wherein a resonance frequency is set up which induces a selective light absorption. This too, runs into a blank wall in the instance of certain dye structures which admittedly can not accommodate oscillatory tautomerism.

The third theory to be mentioned is perhaps the most difficult to accept or refute. Space limitation will not allow a lengthy discussion of this theory so it will be briefly described as a hypothesis involving infra red resonance lines carried exponentially high enough to account for selective absorption in the visible light spectrum.

This theory is criticised as involving mathematical powers which are such a high value that the result can be evaluated as both incorrect or correct and still be within the usual boundaries allowed for error in such computations.

The saga of color is not satisfied with these complicated mazes of contradictory fact and theory, but instead assumes a far greater kaleidoscopic aspect when considered in terms of man's visual reaction to color stimulus. Here the physiologist and psychologist turn their respective backs upon the facts of physics and contemplate certain colors as primary and all other colors as either additive, or subtractive, mixtures.

Additive colors, as used in art pigments, true to the descriptive name are used where several color sources are to transmit a certain hue of light which is but a component of the finished combined color. Perhaps it is easier to think of additive colors as different colored lights which are all thrown upon the same common reflector, the reflected mixture forming the additive color. The subtractive colors are used with pigments, for example, that each absorb part of the light component to be reflected and reflect all others.

With these two usages of three primary colors, any pure hue, in the wave-length sense of the physicist, can be duplicated in man's cortical recognizance mechanism. This cortical stimulus is in no way to be determined different from the brain message obtained by the stimulus of the wave-length-pure light frequency.

This rather astounding fact has formed the basis of the Young-Helmholtz concept of physiological sight which states that man's vision is tri-chromatic.

The Hering theory of vision, in contradiction to the Helmholtz concept, ignores the tri-chromatic nature of the three primary color sources and states that it is what we cortically "see" that is important. Hering states that man is possessed of tetra-chromatic vision in his retina, because we see four primary chroma instead of three—irregardless of the original stimuli. These Hering enumerated as Red, Yellow, Green and Blue.

Mrs. Ladd-Franklin originated a theory which attempted to correlate these two great theories and today remains the subject of much discussion pro and con. The Franklin theory states that while physiological-retinal vision is tri-chromatic, the physiological-cortical stimuli are four in number and therefore tetra-chromatic. The tetra-chromatic concept of Franklin differs from that of Hering in that it considers the optic-nerve stimulus gives us blended colors by an additive effect, rather than a subtractive, or antagonistic effect.

A clear understanding of these three basic color hypotheses requires a familiarity with the physiological television set that comprises our visual mechanism.

The innermost covering of the eye cavity contains the modus operendi of translating light stimuli into nerve stimuli. The retina covers the posterior of the eyeball, extending very nearly to the ciliary muscle, with the end of its visual portion being the "orra serrata," a segmented margin. The pigmented layer of the retina extends over the ciliary body and continues over the back of the iris, as the "uvea."

Blood-vessels; an artery and vein, enter and leave the eyeball with the optic nerve. Because the retinal shadows of the capillaries are plainly visible they constitute a proof that the light-nerve contact proceeds at the rods and cones which make up the nerve terminals of the retina. This is so because except for the outer nucleus, the rods and cones are the only layer which is not fed by the retinal capillaries.

The periphera of the retina contains only the faster reacting rods, which are really but coalesced pencils of sensory cilia which were originally superficial cells before their evolution. These rods give us most of our nocturnal vision and are only able to transmit cortical messages of black and white outline.

The slower, but more discriminatory, cones increase towards the center of the retina and occupy the entire fovea, or color sensitive area. The fovea is only a dent in the retina, a head of a pin is said to cover it, but foveal focus gives our definition of color and perspective detail. It is highly significant, in this respect, that the color-blind are also foveally blind and also that our normal vision fails as night approaches in ratio to our foveal failure, at which time we are unable to distinguish colors.

The fact that in the extreme dusk we are foveal-blind escaped empirical observation until the brilliant researches of Mrs. Ladd-Franklin.

The photosensitive molecules existent in and around the rods and cones of the human retina form a phase of sight investigation that is incomplete even today: the problem offering the myriad facets so consistently found in this general subject.

Scotopic vision, or the dim-light vision executed by the rods, appears a different function than photopic, or detailed cone-vision. We have, in effect, two definite manners in which converging light stimuli revert to nerve stimuli and reach cortical consciousness.

The "pigment epithelium" is thought to be the progenitor of the photosensitive chemical called the visual purple, or Rhodopsin, found on the retinal rods. This molecular substance is probably a hydrocarbon chain similar to vitamin A which is estimated to be C30H20.0. At least the supply of rhodopsin seems to be directly proportional to the availability of vitamin A present in the body.

The name "visual purple" is perhaps a misnomer because it exists in three color states; purple, yellow and white. The yellow and white forms are stages of the bleaching effect upon rhodopsin by bright light.

It is interesting to note that if a dark-adapted eye is exposed to a bright object and subsequently excised, the retina will fixate into the picture, or optogram, if it is treated with a weak solution of alum. The observation that rhodopsin bleaches under bright light in a photo-

electrical (liquid) manner and emits electrons, furnishes an understanding of the dark-adapted phase of vision.

When the light stimuli is too dim to effect a direct satisfactory stimulation of the optic nerve the rhodopsin acts as a super-charger, so to speak. It releases electrons similar to the action of a television photo-electrical cell and gives an additional optic nerve stimulation proportional to the original light stimuli. Thus a dark-adapted eye can see outlines in black and white because of the aid given by electron release by the rhodopsin, or visual purple.*

Cone vision is probably gained by a direct stimulation from the impinging light quanta. Inasmuch as rhodopsin is bleached by strong light its photo-electrical aid to cone vision is doubtful. The discussion of cone and foveal sight brings us to the two conflicting, and one correlating, theories of how we physiologically see color.

The Young-Helmholtz theory, as will be remembered, is based on the belief that sight is tri-chromatic because the three stimuli; red, green and blue, give all other hues by admixture. In this hypothesis the specific spectral hue irritates each of the three fibers of the optic nerve at once, but each fiber is irritated in a different degree. Thus red, for example, would irritate the first fiber strongly and the other two weakly. Red, therefore, would always contain some white as a slight adulteration by the action of our retina. Color-blind subjects at first upset this theory by the fact that they claimed to see yellow and blue clearly, but were blind to green and red and as much as yellow was supposed to be a blend of green and red sensation it did not folow. This objection was gotten around by saying that in the color-blind one spectral hue would stimulate two out of the three nerve fibers in the same degree, instead of all three in a different degree.

The Young-Helmholtz hypothesis has been given much criticism, as have them all, the most significant of which is perhaps its inability

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*(It is my opinion that the following mechanics are probably responsible for this electron release. It would seem logical that one of the three hydrogen atoms present in any methyl group (CH_3) of a photosensitive hydrocarbon chain would be bonded more loosely than the other two. The Pauli exclusion principle would indicate that only two of the three hydrogen present could reside in electron-spin magnetic bonds and thus the third could reside in a loose electrostatic, or coulombic, bond.

In the electronic lattice readjustment occasioned by the quantum-mechanical absorption of light by the photosensitive molecule the electron of this loosely bonded hydrogen would be the most logical to become tautomeric, leaving its ion still bonded by its electrostatic bond.)

to explain disappearing color pairs. That is to say the lack of human ability to see red-greens or yellow-blues; whereas we readily see blue-greens and red-blues.

This act of colors taking pairs has been a factor in justifying the Hering color hypothesis of tetra-chromatic vision. This concept admits the tri-chromatic receptor mechanism in the cones but further stipulates a resultant tetra-chromatic cortical stimulation. Hering supposes four primary color sensations, red, green, yellow and blue. This theory considers these four colors as direct, pure sensations and all other hues as seen by the action of compounded stimuli. A visual molecular substance is considered as a mixture of three anabolic and katabolic pairs, these pairs being red-green, yellow-blue and black-white. A red light, it is stated, acts on the red-green substance, or photochemical pair, and a disassimilation (katabolic change) occurs which gives a red sensation. Conversely the green light would cause an assimilation (anabolic change) causing a green cortical sensation.

The white-black pair is acted upon by all colors, according to Hering. It is this antagonistic effect of black and white which has occasioned much of the criticism of the Hering hypothesis. In reality black and white form a quality blend in the same way that green and blue do. Also according to Hering a red and green stimulus of the same value should result in a white cortical sensation, whereas it is well known that they result in a yellow sensation. This failure of Hering's theory to explain the peculiar position of yellow in relation to the other colors is perhaps his weakest point.

Mrs. Ladd-Franklin's theory of color vision maintains that there are five fundamental color sensations, these being white, blue, yellow, red and green. It is felt that these color senses were progressively developed during the evolution of the light sensitive retinal substance.

The evolution of our color sense happened in three stages, it is contended. In the first stage there was a sensation of light and dark only in the reaction molecule present in primitive sight. The next stage was a refinement of this molecule which responded to the more specific colors of yellow and blue, as in the bees and our own mid-rod-and-cone retinal area. In this mid stage of development the photosensitive molecule is operated upon by the opposite ends of the spectrum and forms white. In the final stage of development the yellow reactant molecule becomes more specific in its response and gives us red and green sensations. Hence when

red and green fall upon the retina they revert to the more primitive yellow, and when blue stimulus is added they result in a white cortical message. Thus in this tetra-chromatic version of sight yellow and white are both secondary products and yet both were present in the more primitive forms of vision. Color-blindness is considered by Ladd-Franklin as merely a reversion to the primitive type of vision.

The same general criticism seems to hold true for all conflicting color theories. Namely: doubt of facts, prejudiced interpretation of empirical data, lack of fundamental knowledge of the precise mechanics of nerve-light excitation and the bearing of the individual psychology theron.

The next great step in integrating our empirical and theoretical knowledge of color will surely come from a clearer and more basic knowledge of selective light absorption. It is possible that the conversion of light quanta to nerve stimulus may not be of a photoelectrical nature, but rather a quantum energy exchange involving photochemical molecular interplay.

Perhaps the C02 release during nerve stimulus is a molecular reversible reaction due to an activation by absorbed light quanta, not an electronic exchange. Wave mechanics offers a suitable framework for such a hypothesis involving a direct conversion of light energy quanta to nerve substance mass and cortical adjustment.

An exact assignment of cause and effect in chemical selective light absorption offering a rigid quantitative and qualitative reference frame would certainly offer a fresh foothold to our army of searchers in their climb of that Mt. Everest of problems, color.

F. L. AVERA,
4107 GARDEN AVE.
LOS ANGELES, CALIF.

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EDITORS

DR. CAREL C. KOCH
1501 Foshay Tower
821 Marquette Avenue
Minneapolis, Minn.

DR. JACK I. KURTZ
1501 Foshay Tower
821 Marquette Avenue
Minneapolis, Minn.

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NOTES ON EYE EXAMINATIONS AND THE PROFESSIONAL PEOPLE ENGAGED IN MAKING THESE EXAMINATIONS

"One sometimes hears" claims Boatman, in THE OPTICIAN, Nov. 12, 1937, p. 257, "of lists of mistakes and oversights made by optometrists. Admittedly no one is infallible. But optometrists could certainly compile a very large volume of well authenticated cases of mistakes made by oculists. Naturally the majority of such mistakes would be in connection with refraction, but that brings me back to my original contention: that the need for specialization in refraction is the essence of the optometrists position, and that the recognition of eye disease, however important in itself, is a side issue."

Boatman then continues, "These are facts which every man can understand and verify for himself. They are born out by the experience of the British Insurance Societies. In England the optometrists (or

the sight-testing opticians, as they are called there) have undertaken by far the greater part of the refraction work under the National Health Insurance for many years past. So far from there being any widespread complaint of neglect or oversight, the Insurance Companies have paid tributes to the efficiency of the optometrists, and have particularly remarked upon the absence of any serious trouble. More than words, however, their actions give proof of their experience—for they show no tendency whatever to abandon the services of the optometrist. In fact the number of insurance companies using the facilities of optometrists has steadily increased."

"When confronted with these facts those oculists who attempt to belittle the optometrist's ability to do his work find no adequate answer. Some, however, do return to the contention that a man not trained as a physician may overlook incipient disease and is therefore unreliable and dangerous." Boatman says in this connection, "The detection of deviation from normal in one particular organ, is a very limited objective, and can be reasonably attained with proper training, especially when the organ in question is subject to direct examination by optical means. Every person understands this perfectly well."

In addition, he says, "One hundred per cent security does not exist in this imperfect world. It is a standard to which physicians themselves cannot for one moment claim to attain. Even relative security has to be abandoned in the realm of general health, and the patient must trust to occasional partial examinations by his general practitioner. To be even relatively certain that he was free from incipient bodily disease, a man would have to insist on an examination by a lung specialist every time he was troubled with a cough, by a nerve specialist when he felt depressed, by a heart specialist when he got out of breath, and so on. In actual practice he hears what his physician has to say—and hopes for the best. Yet it is a very imperfect system, and one constantly hears the remark, 'My doctor was treating me for years without realizing what the trouble was.' This, in a matter where the ultimate penalty is —not loss of sight, but loss of life itself!"

Boatman concludes by writing, "Strange as it may seem, it is nevertheless highly probable that if all refraction work were monopolized by oculists or ophthalmic surgeons, the public would be less secure even in respect of incipient eye-disease. At present, optometrists make a very conscientious preliminary examination of every case to rule out the

presence of pathological conditions. But the busy ophthalmic surgeon, when consulted in connection with glasses, is too often inclined to take the health of the eye for granted. An example from the writer's own experience will illustrate this point: Mr. A. was referred by me to an ophthalmic surgeon because one eye presented a marked ciliary inflammation. He returned with a prescription for reading glasses, and said that he was very disappointed with the examination he had received. According to his statement, the whole interview occupied only a few minutes, the ophthalmoscope was not used, no mention was made of the inflammation (which was still present when he returned) and he was merely tested for reading by the addition of test lenses. It may well be imagined," claims Boatman, "that if this can happen now, when oculists feel at least some pressure from the competition of optometrists, there would be a far greater premium on laxity and carelessness if there were no other alternative service and no other standard of comparison."

Hymans has this to say on the subject, THE OPTICIAN, Vol. LXXXVI, No. 2228, pp. 293-294, 1933. "My dictionary defines a specialist as 'one who devotes himself to a particular and restricted part or branch of knowledge, art or science.' It will not, I think, be denied that the majority of qualified optometrists nowadays devote themselves exclusively to the correction of abnormalities of refraction. They are therefore in a truer sense specialists in this science or art than are the ophthalmic surgeons who are also, and usually more so, concerned with the surgical and medical treatment of diseases of the eye. I willingly concede that there are oculists who are first-class refractionists; but whether because it needs exceptional ability to become really expert both in refraction and in ophthalmic medicine and surgery, or because they often do not use the methods and techniques which have been developed by optometrists, I have no hesitation in saying—and I think most experienced optometrists will agree with me—that the average of accuracy work among oculists is by no means high."

The following brief quotations from the literature in this field are typical of many similar case reports which could be included here as evidence of the lack of real interest in the important subject of ocular refraction on the part of many medical refractionists now engaged in the work of examining eyes and prescribing glasses to correct errors of refraction.

Bailey, an optometrist reports the following case, in THE OPTICIAN, February 22, 1929. "On January 3rd, 1929, a young man, a railway

worker, aged 26, was sent to me by a local medical man, with a request to report upon his visual condition. He had enjoyed good distant vision until three weeks previously, since when his sight had gradually failed. His vision in each eye was found to be only 6/24. No lens improved it, neither did the pin hole disc. With the ophthalmoscope numerous whitish patches were observed in both fundi. I referred him back, with a report that it was a case for medical treatment."

"Next day he came with a prescription for Mist. Pot Bromide, and a few days later with one for Mist. Pot Iodide. His vision was no better. A few days later he suddenly went completely blind, and the eye surgeon was called in, who said it was a case for general medical treatment, and the patient was taken to a local infirmary. He is now out again, his eyesight has returned, but is not as good as it was before his sight first failed. His medical man informed him that he had suffered from optic neuritis, while at the infirmary they informed him he was suffering from uraemia and nephritis."

Cole in the February 1st, 1934 issue of the REFRACTIONIST refers to a case which had been under medical care for a long period. The patient, a woman, was very upset and nervous. Suitable optometric care soon enabled the prescribing of a pair of +4.50 D.Sph. for constant wear and her trouble immediately disappeared.

Prussin, in an article entitled Eyestrain and General Health, AMERICAN JOURNAL OF OPTOMETRY, Vol. 7. No. 11, p. 618, 1930, presents the case of a man 30 years of age who was apparently myopic or near-sighted and who was fitted under a cycloplegic or "drops" with weak concave lenses by an oculist. A few weeks after obtaining this correction he began to suffer severe pains in the right abdomen. Two physicians diagnosed the case as appendicitis. A third physician felt dubious about this diagnosis and referred the patient to an optometrist who by relaxing the convergence by means of orthoptic exercises revealed a high hyperopia which was then corrected. The patient's pain diminished, the symptoms disappeared and there has been no recurrence.

Baxendale discusses a case, THE OPTICIAN, Dec. 3, 1937, which had been referred to an oculist and says, "he had not even tested for astigmatism, but had simply used a letter chart."

The fact of the matter is that many medical men recognize the careless and indifferent refractive work done by many of their fellow workers. In a leading article appearing in the MEDICAL JOURNAL OF

AUSTRALIA, Dec. 10, 1932, we quote the following, "Under existing conditions optometrists certainly have a place in the scheme of things. Incidentally it might be stated that their place has been made larger and their occupation of it more secure by the casual or hurried way in which some of the busy ophthalmic surgeons, particularly among the seniors, treat patients whose only disability is an error of refraction."

This point is covered also in an editorial in the OPTICAL JOURNAL, January 15, 1938, a part of which is as follows:

"Optometrists are fully aware of the humble inception of their calling, but not all of them, and certainly not many in medicine and among the public at large, know of the travail that attended the birth of optometry as a profession. One gets an eloquent picture of the circumstances in which optometry had its beginning from a recently published book, *Tramping to Failure*, by Thomas Hall Shastid, M.D., of Duluth, Minnesota.

"Optometrists will find this volume delightful reading—an autobiography that tells in fascinating style of the wanderings and mental searchings of an inquiring mind who now reflects calmly upon a long career as student and physician of the old school, a novelist and a sincere worker for peace. Of special interest are those pages that describe the early ignorance that prevailed among medical men with respect to eyestrain and its correction, their scornful attitude toward eyeglasses and their utter contempt for the pathfinders of modern optometry.

"Doctor Shastid writes from knowledge born of suffering. Eyestrain handicapped him in his youth and one of the many illustrations in his book shows him at the age of 20 'deeply troubled by rigid Procrusteanism and misunderstood eyestrain.' Recurrent headaches plagued him, and all the village doctors gave him were medicines that made him sick. Finally, at the suggestion of his room-mate at college, he went to an optometrist and was fitted with glasses that give him 'full and adequate relief.' His father, himself a physician, upon learning of the son's eyeglass wearing, urged him to return the spectacles, for 'If you don't, they'll ruin your eyes.' The father shared the strong feeling of the medical profession of that day against the use of glasses by any but the aged. Other general practitioners and oculists as well advised young Shastid that the glasses would ruin his eyes and his brain, too. But as soon as he returned them, back came the headaches and melancholy ensued, and no one could as much as name his affliction.

"The attitude of medicine toward the early optometrists can be readily appreciated, for the art of spectacle fitting a half-century ago was far from the exact science it is today; it was largely a hit-and-miss process, all too often steeped in quackery. A further factor, as the author points out, was that the medical profession at the time was set against specialism even in its own ranks. Outside of the largest cities, it was necessary for a physician who wanted to specialize to be a general practitioner also, and Doctor Shastid had his difficulties because of the medical bias of the day.

"Doctor Shastid asserts that optometry had its rise mainly because of the failure of the medical profession to recognize and meet the public need in matters of eyecare. The medical men, the author says, would not recognize the existence of eyestrain, and for eyestrain headache they prescribed drugs, sometimes with the result that drug addicts were produced. 'If there was any worse quackery than this of the regular medical profession, I know not what it was,' Doctor Shastid declares. 'Yet they called "quacks" all those who fitted glasses to the eyes of the young.'

"Because of his own suffering from unrelieved eyestrain, Doctor Shastid has special cause to remember that the old-time optometrists, unskilled as they were, succeeded in relieving many of the simpler cases of headache, sick stomach and nervous disorders due to eyestrain. 'Such men, speaking generally,' the author says, 'excited extreme contempt and bitterness on the part of the "regular" profession, feelings which grew the more the optometrists beat these scientific M.D.'s at the treatment of eyestrain and its numerous results. Incredible, yet unqualifiedly true.'

"Their stubborn opposition to the fitting of glasses for anything except 'old sight' weakened the standing and influence of the physicians and gradually the optometrists grew in importance, service and public esteem and gave up their itinerant ways. The medicos tried to get legislation to bar the eyeglass fitters from practicing but without result, for always there were many satisfied patients to testify to the value of their service. The optometrists continued to grow in numbers and influence, finally getting legislation setting-up boards for the examination and licensure of optometrists. 'And so,' Doctor Shastid concludes, 'a new profession was born—out of the unmitigated quackery, the absolutely outrageous neglect of an important branch of the healing art by the regular medical profession.' But he adds immediately: 'But "time cures all things," and now . . . the optometrists of America are laboring mightily to elevate their own standards, and with a considerable measure

of success.' And he adds further that the medical profession itself has never attempted to get any legislation whatsoever that would require special education for medical men as specialists.

"In pointing to their shortcomings, Doctor Shastid spares neither optometry nor ophthalmology. Who was at fault? The author answers this by saying that if the general practitioners, instead of "faking it" with medicines, had referred their eyestrain patients to competent medical specialists, there would never have been a separate profession of optometry.

"Concerning his book, we are privileged to quote from a letter from Doctor Shastid wherein he says:

" 'The chief passages in it on the subject of optometry begin, respectively, on pages 76, 86, 165, 166, 169, 170. In these various passages I have attempted to tell the absolute truth, without either favor or prejudice, concerning the rise of both optometry and of M.D. eye specialism. That is at best a dirty chapter in the medical history of America—dirty all around—with, however, the chief fault lying with the general M.D. practitioners—no doubt about that. It has cost me many friends to tell the all-around truth about that stark, black tragedy, but it never had been plainly set forth before and I wanted the record to be complete. Surely, both the M.D.'s and the optometrists have now attained to a level of development where they can tolerate the publication of the truth. In no other way, indeed, than on a basis of the truth and the frank admission of historical shortcomings on both sides can a friendly and final adjustment between M.D. oculists and optometry be made. As to which—God speed the day!' "

That eye work is not taken as seriously as it should by some medical men is evident in reading the following report taken from the May 25th issue, 1934, of THE OPTICIAN. The report deals with a lecture on Eye Injuries in Industry, given before the Industrial Welfare Society. The speaker is Bernard Cridland, M.D., Fellow of the Royal College of Surgeons. Cridland is also the representative for Great Britain on the International Association for the Prevention of Blindness. Cridland says, page 258, "They had a committee of working men in Wolverhampton in connection with the Hospital, the members of which represented various firms, and he had told them that if they could find trained men, he was quite prepared to let them come to his hospital and be taught how to remove foreign bodies (which had lodged in the eye). He would not mind them using cocaine with care. . . ." Dr. G.

Burnet then objected to Cridland's views on letting laymen remove foreign bodies from the eye with the aid of cocaine, but Cridland is quoted as saying, "that people must be educated to the use of cocaine."

Knapp writing in the DIOPTRIC REVIEW, June, 1933, says, "It is necessary to emphasize that the optometrist has specialized in his study of the correction of errors of refraction. It is his living, and his claim to professional status, which is at present his highest ambition. He understands it and practices it infinitely better than does the average oculist or ophthalmologist. I know of many optometrists whom I would engage in my consulting rooms, but very, very few ophthalmologists. Nor is this singular to Australia. Go where you will, to the big English Ophthalmic Hospitals, to Harley Street, wherever ophthalmologists are found, their refraction work is usually poor, and not infrequently very bad. They never seem to have a flair for this section of their work."

S. Taylor in THE OPTICIAN, Oct. 1, 1937, says in regard to optometrists, "A good refractionist is better able to differentiate between a healthy eye and a diseased one than the average general practitioner. . . . I will go further and say that the above statement holds good with regard to most of the pseudo-ophthalmic surgeons (oculists) leaving us with a comparatively small number of genuine ophthalmic surgeons who can be relied upon to make a proper diagnosis. . . ."

Writing on the subject of eye examinations, Swann in THE OPTICIAN, Dec. 17, 1937, p. 354, says, "Should propaganda be spread that cycloplegics (drops) are essential in refraction work, our answer will be more convincing if we can offer technical reasons for not using them. Further, it is our duty to go forward and prove that medical refraction work is based on false theories and premises."

The oculist Dorland Smith, also writing with reference to eye examinations made with "drops" or cycloplegics says, AMERICAN JOURNAL OF OPHTHALMOLOGY, June, 1931, p. 500, that this form of ocular refraction is quite undependable unless the cycloplegic paralysis caused by the use of the "drops" is known to be absolutely complete. Edwin F. Tait, Ph.D., in his monograph on this very subject published several years later, VOLUME IX, TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY, 1936, p. 76-83, shows that this paralysis, referred to by Smith, is very undependable, when employed in the manner now in use by many of the oculists of America. Tait's experimental work in this field showing the clinical use of homatropine or "drops" to produce

no constant paralysis of the ciliary muscle in a large number of controlled cases.

J. F. Martin, M.D., in the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, February 26, 1938, says, "At a recent postgraduate course a well known ophthalmologist in a lecture advocated the use of one drop of benzedrine sulfate 1 per cent, followed twenty minutes later with one drop of 5 per cent homatropine, as a cycloplegic, stating that these drugs were much better than atropine." Martin then asks, "I should like to know if it is safe to use these drugs in this way; have they been used to any great extent?" The editorial staff of this medical journal answered his question as follows. "The latest report by Dr. Judd Beach recorded the satisfactory use of these cycloplegics in more than 200 cases. Others who have been trying the method have not mentioned the number of cases in which it was employed. It is certain that in predisposed cases this cycloplegic, as well as any cycloplegic that is accompanied by a mydriatic effect, will cause a certain amount of increase in intra-ocular pressure. Consequently, it behooves any physician using any drug that causes a dilation of the pupil to be on guard continuously against increased intraocular tension."

In discussing the effect of "drops" or cycloplegics, Moevius, in THE OPTICIAN, June 22, 1934, says, there is the possibility of a dangerous after effect as the result of the use of a cycloplegic." D. T. Atkinson, M.D., in his new book, THE OCULAR FUNDUS IN DIAGNOSIS AT TREATMENT, Lea & Febiger, Philadelphia, 1937, p. 21, says, "Some types of cycloplegics may be dangerous because of their tendency to increase intra-ocular tension." Dr. Ernest Fuchs in his book OPHTHALMOLOGY, p. 473, says, "mydriatics on the contrary can excite an inflammatory attack in an eye that is predisposed to glaucoma and not only the powerful mydriatic atropine, but also homatropine and cocaine." Fisher in his book OPHTHALMOSCOPY, RETINOSCOPY AND REFRACTION says, "Before using atropine in a middle aged patient, carefully consider the possibility of producing glaucoma in that particular case." May, too, in his book, DISEASES OF THE EYE, fourteenth edition, says, "Before using atropine or homatropine in the eyes of adults any suspicion of glaucoma must be excluded." And Snelling is quoted by Morris, DIOPTIC BULLETIN, Vol. XXX, No. 6, pp. 306-307, as saying, "Any mydriatic solution instilled in the conjunctival sac, may produce general disturbances which sometimes assume a most alarming character and may even cause the death of the patient." Morris also quotes Butler as saying,

"The amount of confusion caused by a dilated pupil, where there is an error of refraction is extraordinary. I can be more accurate with the moderate-sized pupil than with the dilated one." These quotations on the subject of "drops" are all from the writings of some of the most prominent oculists of the day. Men in the very front rank of their profession and each a leader and a thinker of note.

L. J. Stone of Columbia University writes in PSYCHOLOGICAL ABSTRACTS, Sept. 1937, No. 4174, a review of a study made on atropine psychoses. This material is taken from the Russian. V. V. Shostakovich, E. P. Golubenko, E. F. Kulikova, and N. I. Pogibko. Atropinnye psikhozy. In Rokhlin, L. L., Problemy Klinicheskoi i Experimentalnoi Nevropatologii i Psikiatrii. Kharkov: Urk. Psikhonevrol. Akad., 1936, pp. 312-320. These investigators say, "While much is known of the effect of atropine on the autonomic nervous system, its effect on the higher centers is almost unknown. 20 cases of atropine poisoning were observed over a short period. A complex psychotic picture is found, exhibiting three stages: (1) hyperactivity of the sympathetic division: (2) strong-motor excitement, hallucinations, delirium, etc.; (3) a comatose state." The authors are further quoted as saying, "The cure of the disease may be very stormy or somewhat prolonged, varying from a few hours to four days. Following the psychotic state, headaches, weakness, dullness and apathy may be found. Most patients later recall the psychotic state. The clinical picture, contrary to Bonhoeffers principles of exogenous psychoses, has characteristics differentiating it from other acute intoxications."

McCulloch and Peckham discuss the ease in which accommodation can be mechanically relaxed and the more accurate results which come from this technique as compared to the use of "drops." They say, AMERICAN JOURNAL OF OPTOMETRY, Vol. 2, No. 12, pp. 363-364, 1925, "These cases have several features in common. All had been refracted under a cycloplegic, with failure to either learn the full error or to give ocular comfort. The reader will note the false amount of astigmatism and the wrong cylinder found when atropine or homatropine was used in several of these cases. These records indicate that the cycloplegic used will not relax the accommodation in cases where there is a close association between accommodation and convergence." The authors then cite five cases. These all accepted more plus corrections when examined without a cycloplegic than when examined with one and each case reported complete comfort with the final non-cycloplegic finding in use.

In this same connection Aronsfeld discusses making an ophthalmoscopic examination of the interior of the eye. He says, THE OPTICAL JOURNAL-REVIEW, Nov. 15, 1937, p. 20, "During an ophthalmoscopic examination, the macular region should be given very careful study. For some reason, many writers and teachers have stressed the difficulty of seeing the macular region in a case with an undilated pupil, but I cannot share this view. If a satisfactory instrument is available, and if the examiner places the patient in the proper position with the patient viewing a target placed on the ceiling, the inspection of the macula and the surrounding region should offer no unusual difficulty."

Edward Jackson, M.D., in a paper on School Clinics, brings out the same point, THE AMERICAN JOURNAL OF OPHTHALMOLOGY, April, 1933. He says,[1] "Since parents are slow to realize that their children may need glasses, the work of the school eye clinic is of the utmost importance. The child should be examined with the ophthalmoscope, generally the test can be made with the pupil undilated."

"Since 1924," writes Swann in THE OPTICIAN, Dec. 17, 1937, p. 353, "ophthalmic instrumentation has gone ahead to an extent not witnessed in previous years. This advance has naturally altered one's outlook on the subject of eye examination. The modern ophthalmoscope has eliminated the use of the mydriatic, and the ultimate ophthalmoscope is yet to come. I have always upheld the value of cycloplegics (drops) in certain cases and have had considerable experience in their use. . . . During the last five years the use of cycloplegics in our private practice has decreased to a negligible number."

This is covered also by the physician, Dorland Smith, who, writing on the subject of examining eyes without the use of "drops" or cycloplegics, AMERICAN JOURNAL OF OPHTHALMOLOGY, June, 1931, p. 509, says, "As one learns the possibilities and limitations of the method by experience, watches its revelation of the anomalies of the accommodation, and comes to know the amounts of relaxation to be expected with different kinds and degrees of refractive error, he will find that he needs a cycloplegic much less often."

"Modern instruments and methods," also claims Maybee, THE CANADIAN OPTOMETRIST, Vol. X, No. 6, p. 174, 1928, "have made it entirely unnecessary to employ cycloplegics or 'drops' for the purpose of detecting and correcting errors of refraction." On this Maybee is not

1. Abstract in The Dioptric Review, June 1933. P. 191.

writing at random, having used various cycloplegics for a number of years, and having voluntarily discarded them many years ago as unnecessary, unscientific and dangerous. "Drugs cannot improve the information secured by drugless methods," he says, and adds, "with drugs, the distended pupil brings into use peripheral portions of the crystalline lens which are not used when the pupil resumes its normal size. This makes for inaccuracies in the findings of both subjective and objective tests."

The physician and eye specialist, the late Hon. Royal S. Copeland, United States Senator from New York, in a Commencement address at the Pennsylvania State College of Optometry, Philadelphia, on June 1, 1937, said, "Quite recently I had occasion to witness what the United States Government is doing in aviation, particularly as to the methods of guarding against the attacks of enemy planes. As I saw what has been accomplished, largely in the field of physics, it saddened me to think that medicine is not making comparable progress in the application of scientific research to the betterment of human health.

"With this thought in the back of my head, I happened to read a sentence in the latest annual announcement of the Pennsylvania State College of Optometry. It is this: 'Optometry depends far more upon the mathematical and physical sciences than does any other profession having to do with the care of the human body.'

"This is a succinct statement of an absolute truth. General medicine is not founded upon principles so demonstrable as are the facts governing in your field of applied knowledge. While scientific discovery has made the prescribing of the physician increasingly accurate, it must be admitted that in dealing with many diseases the practice of medicine continues to be largely a matter of empiricism and experiment.

"It is probable that the human equation must always be a factor in the practice of your profession and mine. Fortunate as the optometrist is in the reliability of the principles underlying his profession, there is always the individual peculiarity to be considered. Your instruments of precision have established to a nicety just what combination of lenses will completely overcome the error of refraction. But the patient may be just as uncomfortable, perhaps more, than he was before he acquired his spectacles.

"It is in such a case that your knowledge of psychology may prove to be more important than your knowledge of optics. I speak from sad experience.

"It comes to this, I take it, that in the last analysis the patient must be dealt with as an individual: his personal peculiarities must be considered. In short, we must individualize the patient; generalization will fail in a percentage of cases. But you are more fortunate than members of other professions. You can depend upon mathematics and the physical sciences and be let down less frequently than are the followers of other professions having to do with human beings."

Gruman, in the OPTICAL JOURNAL, Jan. 15, 1938, referring to the educational background of the oculist, says, "The American Academy of Otology and Ophthalmology is aware of the inadequate training of the many physicians attempting to do eye work and has endeavored to encourage them into a more thorough preparation for their work. But since such post-graduate studies must (because of the lack of present-day legal requirements) depend on purely voluntary efforts of the would-be specialists, they are doomed to indifferent success at best."

Turville, writing in the OPTICIAN, November 8, 1929, says, "When Helmholz first introduced the ophthalmoscope, a fellow surgeon is reported to have said, 'It would be too dangerous to admit a naked light into a diseased eye.' Another colleague was of the opinion that the ophthalmoscope might be of service to oculists with defective eyesight—he himself had good eyesight and wanted none of it." Turville concludes by saying, "Each new instrument, method or theory as it comes, receives its amount of destructive criticism from the many. Constructive criticism comes from the few."

Tibbles, writing in the BRITISH MEDICAL JOURNAL, Nov. 27, 1937, and commenting on the fact that most patients are having their eye refractions done at the offices of optometrists, asks, "What is to become of the eye surgeons of the future, as they cannot possibly live on the small percentage of cases of diseased eyes . . . ?"

Leather also suggests that there may be an economic reason behind the recent criticisms directed towards the profession of optometry by a certain few oculists. He writes in THE OPTICIAN, June 12, 1936, p. 333, as follows: "With the overcrowding of the medical profession, it is little cause for wonder that there should be an attempt at conquest of the optometrists territory, and whatever altruistic motives are set up to justify the campaign, it is, at bottom, the only one that seems to matter in modern affairs, i.e., economic necessity."

Churchyard, however, discusses various refractionists and says, in THE OPTICIAN, Dec. 8, 1933, p. 293, "I venture to say that it has been the experience of most of us that once a person of any social or financial class has been prescribed for by a competent optometrist, he does not again consult an ophthalmic surgeon for refraction."

CAREL C. KOCH.

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ABSTRACTS

THE EYE-GROUND FINDINGS IN BRIGHT'S DISEASE. J. T. Gordan, M.D. The Indiana Optometrist. Vol. VIII, No. XII., pp. 6-9. 1938.

According to Gordon the ocular symptoms in Bright's disease and in nephritis are those of retinitis in general. The condition is usually bilateral and very rarely unilateral. The degree of visual disturbance is dependent upon the severity of the inflammation or degeneration and upon the location of the affected areas.

Small changes in the macular region may result in extreme visual disturbance, while much larger areas of the fundus in other parts may be affected with little resulting visual disturbance. The pathological findings on ophthalmoscopic examination are changes due to high blood pressure. The characteristic findings which seem to be pathognomonic of Bright's disease and chronic nephritis are; (1) swelling and haziness of the retina and of the papilla, (2) distention and tortuosity of the retinal vessels, especially the veins, (3) irregularity of the lumen of the vessels with areas of constriction, (4) the arteries cross the veins more nearly at right angles than usual to obliterate the vein at that point or nearly so, (5) increased light reflex along the vessels giving it the "silver wire appearance," (6) hemorrhages into the retina, in the form of round spots of flame shaped hemorrhages or gross extravasations of blood, (7) to the above is added the principal distinctive finding, white peripapillar snow-wool exudate. Due to this finding the entire picture is often referred to as albuminuric retinitis. At the macula there may early in the disease be only a few small white dots but as the condition progresses these areas arrange themselves in a spoke-like fashion with the fovea for a

center. A ring like structure may form around the disc as the result of the coalescence of the spots. (8) Choked disc is ordinarily not seen until the approach of uremia.

Gordon points out, however, that while disturbances of vision are of great diagnostic and prognostic significance in Bright's disease it is necessary to understand that the eye ground findings by themselves do not constitute sufficient clinical evidence for an absolute diagnosis of Bright's disease. C.C.K.

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ORTHOPTIC TRAINING ROOM. J. F. Morrow. Bulletin of the Optometrical Society of the City of New York. Vol. 4, No. 2, p. 4. 1938.

Morrow reviews the development of orthoptic training in the past ten years and suggests for those optometrists engaged in this work that the arrangement found most useful is to separate all the refractive instruments from those used in orthoptic training. This requires that a special room be set aside for orthoptic treatments. T.O.B.

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THE SHEARD FOUNDATION. Editorial. The Optical Journal and Review of Optometry. Vol. LXXV., No. 22, p. 24. 1938.

Ohio optometrists made their recent annual convention in Columbus the occasion for launching the Sheard Foundation for Research and Education. The new venture, appropriately enough, takes its name from Dr. Charles A. Sheard, head of the biophysics department at the famous Mayo Clinic, one of the profession's most distinguished men and at one time head of the School of Optometry at Ohio State University.

The purpose of the Foundation is to foster education and promote research in physiological optics and professional optometry. The work of the Foundation is expected to supplement and unify investigations now in progress in the School of Optometry at Ohio State.

Whatever funds become available will be used for the following purposes, it is announced: (1) To provide fellowships to encourage

those interested in physiological optics or optometry to avail themselves of the facilities of the Foundation for advanced study and research. (2) To purchase laboratory apparatus and equipment necessary for research on problems. (3) To secure clinical and research assistants to carry on investigations initiated by the Foundation. (4) To publish the results of investigations carried out under the direction of the Foundation.

T.O.B.

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IMPROVING ROUTINE EXAMINATIONS. W. Ralph Coates. The Dioptric Review. Vol. XL., No. 4, pp. 284-292. 1938.

Coates reviews the literature dealing with examination routines and points out that there seems to be a tendency both in England and in America for longer and longer ocular examination periods. He discusses the actual 41 steps to be taken in the so-called 21 point routine examination as suggested by Jaques and adds, "Dr. Jaques is not alone in recommending lengthy examinations. At the London Refraction Hospital the routine tests take a very considerable time. And there was also another famous American optometrist who said that he always had his patients back a second time before writing out a prescription, and if the case required it they had to come back a third or even a fourth time. What is more, the present tendency in America is for longer and longer examinations. Any new teacher who wishes to 'put one over' on his rivals is considered to have done so if the special system he invents contains more points than the previous longest. Long before this tendency reaches rock bottom our friends on the other side of the Atlantic will have to take a leaf out of the book of Müller of Wiesbaden, the famous fitter of contact lenses. He has a long waiting list and each client lodges and boards with him until suited. Every day two or three new contact lenses are made and the patient wears one for as long as he can under Herr Müller's personal supervision, until the pain becomes too severe, when a rest is allowed before another is tried. The average time taken is three weeks, and the bill, which is a nice round figure, includes board, lodging, professional services and one contact lens. So if the present trend continues we may live to see the day when there will be a boarding establishment connected with every optometrist's office!"

Coates then suggests the following basic nine steps to be taken in each examination, claiming that in 90 per cent of the cases these will be sufficient. (1) Case History. (2) Visual Acuity. (3) Static Retinoscopy. (4) Dynamic Retinoscopy. (5) Subjective test. (6) Distance phorias. (7) Near phorias. (8) Ophthalmoscopic examination. (9) Facial measurements, etc. In the remaining ten per cent of the cases Coates admits additional tests are required. C.C.K.

* * * * *

ORTHOPTICS. L. Wardlaw. The Scope. Vol. 4, No. 5, p. 10. 1938.

Wardlaw comments on the suggestions made by Knowles as to the requirements for an instrument to be used in orthoptic training. These requirements are, (1) the instrument should be a stereoscope. (2) The instrument should have rotary motion. (3) The instrument should have diagnostic features so as to enable the optometrist to easily take both the phoria and duction findings. (4) The instrument should be so constructed as to train both the eye and the hand. (5) The instrument should be so constructed as to permit of visibility control for the patient as far as this is possible to assure the balancing of retinal images. (6) The instrument should be constructed to assure control of both accommodation and convergence when in use. (7) The instrument should be adaptable to the speed required for the patient to fix the images and, (8) the instrument to be of value should be simple and easy to operate.

T.O.B.

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